

# IDAHO NATIONAL ENGINEERING LABORATORY

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Evaluation of Utility Response to  
Supplement 1 to NRC Bulletin 90-01:  
Pilgrim

Idaho National  
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Idaho Technologies Company

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TECHNICAL EVALUATION REPORT

Evaluation of Utility Response to Supplement 1 to  
NRC Bulletin 90-01: Pilgrim

Docket No. 50-293

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### SUMMARY

This report documents the Lockheed Idaho Technologies Company review of the Boston Edison Company submittals that respond to Supplement 1 to NRC Bulletin 90-01 for the Pilgrim Nuclear Power Station. This NRC Bulletin provides information regarding the loss of fill-oil in certain pressure and differential pressure transmitters manufactured by Rosemount, Inc. This report finds the licensee complies with the requested actions and the reporting requirements of the Supplement.

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## PREFACE

This report is supplied as part of the "Technical Assistance in Support of the Instrumentation and Controls Systems Branch." It is being conducted for the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Division of Reactor Controls and Human Factors, by Lockheed Idaho Technologies Company, National Nuclear Operations Analysis Department.

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Evaluation of Utility Response to Supplement 1 to  
NRC Bulletin 90-01: Pilgrim

1. INTRODUCTION

The NRC issued Bulletin 90-01 on March 9, 1990 (Reference 1). That Bulletin discussed certain Rosemount pressure and differential pressure transmitter models identified by the manufacturer as prone to fill-oil leakage. The bulletin requested licensees to identify whether these transmitters were or may later be installed in safety-related systems. Actions were detailed for licensee implementation for certain identified transmitters installed in a safety-related system. These same actions apply to those identified transmitters presently held in inventory for later installation in a safety-related system.

With the gradual leakage of fill-oil, the transmitter would not have the long term accuracy, time response, and reliability needed for its intended safety function. Further, this condition could go undetected over a long period. Redundant instrument channels are subject to the same degradation mechanism. This increases the potential for a common mode failure. Thus, this potential failure mechanism raised concern for the reliability of reactor protection systems (RPS), engineered safety features (ESF) actuation systems, and anticipated transient without scram (ATWS) mitigating systems. To achieve high functional reliability, there must be a low probability of component failure while operating, with any failures readily detectable.

Supplement 1 to NRC Bulletin 90-01 (Reference 2) was issued on December 22, 1992. The Supplement informed licensees of NRC staff activities regarding the subject transmitters, and noted continuing reports of transmitter failures. The NRC requested licensee action to resolve the issue. The Supplement also updated the information contained in the original bulletin. The licensee was requested to review the information and determine if it was applicable at their facility. Further, the licensee was requested to modify their actions and enhanced surveillance monitoring programs to conform with the direction given. Finally, the licensee was instructed to



respond to the NRC. The Requested Actions in Supplement 1 to NRC Bulletin 90-01 supersede the original NRC Bulletin 90-01 Requested Actions.

In responding to Supplement 1 to NRC Bulletin 90-01, the licensee is directed to address three items.

1. A statement either committing the licensee to take the NRC Bulletin 90-01, Supplement 1, Requested Actions or taking exception to those actions.
2. Addressing the actions committed to in the above statement, provide:
  - a. a list of the specific actions, including any justifications, to be taken to complete the commitment,
  - b. a schedule for completion, and
  - c. after completion, a statement confirming the actions committed to are complete.
3. A statement identifying the NRC Bulletin 90-01, Supplement 1, Requested Actions not taken, along with an evaluation providing the basis for exemption.

In implementing the replacement option of the NRC Requested Actions, plant shutdown exclusively for replacing the transmitters is not required. This allowance infers that replacements can be scheduled. With replacement in a timely manner, enhanced surveillance monitoring for interim operation is not required.

The Boston Edison Company, the licensee for the Pilgrim Nuclear Power Station, responded to Supplement 1 of NRC Bulletin 90-01 with a letter dated March 5, 1993 (Reference 3). The licensee provided additional information in a report dated August 30, 1993 (Reference 4). This technical evaluation report evaluates the completeness of those submittals. It also determines whether proposed surveillance methods are adequate to determine fill-oil loss-



caused degradation of the transmitter. Finally, this report addresses the interval of surveillance proposed by the licensee for any transmitters included in the enhanced surveillance monitoring program.

Many Rosemount transmitter failures have been attributed to the use of stainless steel "O"-rings between the sensing module and the process flanges. Rosemount improved the manufacturing process for transmitters manufactured after July 11, 1989. Those improvements included a limit of the torque applied to the flange bolts. This limits the stress caused in the sensing module by the "O"-ring. Post-production screening, including pressure testing of the sensing module for this potential latent defect, was also implemented at that time. Therefore, as described in Supplement 1 of NRC Bulletin 90-01, those Rosemount transmitters manufactured after July 11, 1989, are not subject to this review.

## 2. NRC SPECIFIED REQUESTED ACTIONS

The NRC staff specified the following Requested Actions of licensees of operating reactors.

1. Review plant records and identify the following Rosemount transmitters (if manufactured before July 11, 1989) that either are used in or may be used in either safety-related or ATWS mitigating systems.

- Rosemount Model 1153, Series B
- Rosemount Model 1153, Series D
- Rosemount Model 1154

Following identification, the licensee is to establish the following:

- a. For those identified transmitters having a normal operating pressure greater than 1500 psi, and are installed as part of reactor protection trip systems, ESF actuation systems, or ATWS mitigating systems, either replace the transmitter in an expedited manner, or monitor monthly, for the life of the transmitter, using an enhanced surveillance program.

If the identified transmitter exceeds the 60,000 psi-month or the 130,000 psi-month criterion (depending on the range code of the transmitter) established by Rosemount, enhanced surveillance on a refueling (not exceeding 24 months) basis is acceptable. Under this option, justification must be based on the service record and the specific safety function of the transmitter. That justification can be based on high functional reliability provided by redundancy or diversity.

- b. For those identified transmitters having a normal operating pressure greater than 1500 psi, and are installed as part of a safety-related system other than reactor protection trip systems, ESF actuation, or ATWS mitigating systems, either replace the transmitter or monitor quarterly, for the life of the transmitter, using an enhanced surveillance program.

If the identified transmitter exceeds the 60,000 psi-month or the 130,000 psi-month criterion (depending on the range code of the transmitter) established by Rosemount, enhanced surveillance on a refueling (not exceeding 24 months) basis is acceptable. Under this option, justification must be based on the service record and the specific safety function of the transmitter. That

justification can be based on high functional reliability provided by redundancy or diversity.

c. For boiling water reactors (BWR)--

For those identified transmitters having a normal operating pressure greater than 500 psi and less than or equal to 1500 psi, and are installed as part of reactor protection trip systems, ESF actuation systems, or ATWS mitigating systems, either replace the transmitter, or monitor monthly with an enhanced surveillance monitoring program, until the transmitter reaches the designated (by Rosemount) psi-month criterion (60,000 psi-month or 130,000 psi-month, depending on the transmitter range code).

For transmitters that provide signals to the RPS or ATWS trips for high pressure or low water level, the enhanced surveillance must be monthly. For other transmitters in this classification, enhanced surveillance on a refueling (not exceeding 24 months) basis is acceptable. Under this option, justification must be based on the service record and the specific safety function of the transmitter. That justification can be based on high functional reliability provided by redundancy or diversity.

For pressurized water reactors (PWR)--

For those identified transmitters having a normal operating pressure greater than 500 psi and less than or equal to 1500 psi, and are installed as part of reactor protection trip systems, ESF actuation systems, or ATWS mitigating systems, either replace the transmitter, or monitor with an enhanced surveillance monitoring program, until the transmitter reaches the designated (by Rosemount) psi-month criterion (60,000 psi-month or 130,000 psi-month, depending on the transmitter range code) on a refueling (not exceeding 24 months) basis.

- d. For those identified transmitters having a normal operating pressure greater than 500 psi and less than or equal to 1500 psi, and are installed as part of a safety-related system other than reactor protection trip systems, ESF actuation, or ATWS mitigating systems, either replace the transmitter or monitor with an enhanced surveillance monitoring program, until the transmitter reaches the designated (by Rosemount) psi-month criterion (60,000 psi-month or 130,000 psi-month, depending on the transmitter range code) on a refueling (not exceeding 24 months) basis.

- e. Those transmitters having a normal operating pressure greater than 500 psi and less than or equal to 1500 psi, and have accumulated sufficient psi-month operating history to exceed the criterion established by Rosemount, may be excluded from the enhanced surveillance monitoring program at the discretion of the licensee. However, the licensee should retain a high level of confidence that a high level of reliability is maintained and that transmitter failure due to loss of fill-oil is detectable.
  - f. Those transmitters having a normal operating pressure less than or equal to 500 psi may be excluded from the enhanced surveillance monitoring program at the discretion of the licensee. However, the licensee should retain a high level of confidence that a high level of reliability is maintained and that transmitter failure due to loss of fill-oil is detectable.
2. Evaluate the enhanced surveillance monitoring program. The evaluation is to ensure the measurement data has an accuracy commensurate with the accuracy needed to compare the data to the manufacturers drift data criteria. It is this comparison that determines the degradation threshold for loss of fill-oil failures of the subject transmitters.

The Supplement also states the NRC may conduct audits or inspections in the future to verify compliance with the established requirements.

### 3. EVALUATION

The licensee provided a response to Supplement 1 of NRC Bulletin 90-01 on March 5, 1993. The licensee submitted additional information in a report dated August 30, 1993. Those responses were compared to the Bulletin Reporting Requirements and Requested Actions as described below. The licensee reports having 40 Rosemount transmitters that are subject to the Requested Actions of the Supplement. The licensee also reports having 33 Rosemount transmitters that are outside the scope of the Supplement, due to replacement or refurbishment.

#### 3.1 Evaluation of Licensee Response to Reporting Requirements

The licensee states they have taken the Requested Actions detailed by Supplement 1 of NRC Bulletin 90-01. Included with that statement is clarification, interpretation, and the limits placed on that commitment. The licensee described the specific actions taken to implement the Requested Actions of the Supplement.

The Reference 3 submittal identifies where the licensee took no action, and provided evaluation and justification supporting the position that the action is not necessary. That submittal includes a current list of Rosemount transmitters and their operational history. The licensee identified one spare transmitter for return to Rosemount for repair or refurbishment after refueling outage No. 9. Further, the licensee committed to make their enhanced surveillance monitoring program formal by incorporating it into new station procedures by May 30, 1993. Reference 4 evidences that these actions are complete. The enhanced surveillance monitoring program is now part of routine plant operations.

The licensee submittals conform to the Reporting Requirements of Supplement 1 of NRC Bulletin 90-01.



### 3.2 Evaluation of Licensee Response to Requested Actions

Supplement 1 of NRC Bulletin 90-01 requested licensee action to resolve the issue of fill-oil leakage in Rosemount transmitters. In this Technical Evaluation Report, the Requested Actions and associated transmitter criteria are summarized in Section 2. The licensee identified a total of 73 Rosemount transmitters; 40 within the scope of this review. The licensee has no Rosemount model 1153, series D, or model 1154 transmitters installed at the Pilgrim Nuclear Power Station. The following sections discuss the licensee response to the Supplement.

#### 3.2.1 Licensee Response to Requested Action 1.a

The licensee states there are no Rosemount transmitters from this transmitter classification at the Pilgrim Nuclear Power Station.

#### 3.2.2 Licensee Response to Requested Action 1.b

The licensee states there are no Rosemount transmitters from this transmitter classification at the Pilgrim Nuclear Power Station.

#### 3.2.3 Licensee Response to Requested Action 1.c

The licensee indicates there are 12 Rosemount transmitters from this transmitter classification at the Pilgrim Nuclear Power Station that are subject to the Requested Actions of the Supplement. None of these 12 transmitters has reached the maturity threshold established by Rosemount and endorsed by the NRC.

Two transmitters monitor the main steamline flow and provide signals to the primary containment isolation system. These 2 transmitters are part of a total of 16 Rosemount transmitters that monitor the flow in the main

steamlines. The other 14 transmitters have manufacture dates after July 11, 1989, or have a sensing module manufactured after July 11, 1989.

Two transmitters monitor the reactor vessel water level and provide signals to the RPS. Each has a redundant channel, where the transmitter has a manufacture date after July 11, 1989, or has a sensing module manufactured after July 11, 1989.

Four transmitters monitor the reactor vessel pressure and provide signals to the emergency core cooling system. Two of the transmitters are redundant to each other. The other two transmitters have redundant channels - one transmitter with a manufacture date after July 11, 1989; the other transmitter with a sensing module manufactured after July 11, 1989.

Four transmitters monitor the turbine first stage pressure and provide a signal to the RPS bypass permissive circuits. Each of these transmitters is redundant to the other three.

The licensee monitors the transmitters described above monthly, on-line, using the emergency and plant information computer (EPIC). The licensee also monitors these transmitters by trending calibration data, taken at refueling outages. The licensee trends the accumulated zero drift of each transmitter and compares the total drift to the limits found in Rosemount Technical Bulletin No. 4. The enhanced surveillance monitoring program for these transmitters is acceptable.

The licensee also discussed three Rosemount transmitters (the fourth is refurbished) that monitor the scram discharge volume level and provide signals to the RPS. The RPS trips if the scram discharge free volume is not enough to contain the water discharged from the control rod drives on a scram. These transmitters normally operate at atmospheric pressure. With a reactor scram, the scram discharge volume isolates from the equipment drain tank, and the transmitters operate at up to 1130 psig until the instrument volume drains.



LT302-82A has operated for 2,829 days. LT302-82B and LT302-82D have each operated for 2,833 days. However, significant psi-month operational history is not accumulated. Therefore, these transmitters do not have enough time at pressure to lose a critical amount of fill-oil, now or in the near future. Rosemount Technical Bulletin No. 4 recognizes this situation, classifying such standby transmitters as transmitters not at risk. These transmitters participate in the enhanced surveillance monitoring program that uses the accumulated zero drift compared to the limits found in Rosemount Technical Bulletin No. 4. The licensee obtains calibration data during each refueling outage. Based on the minimal at-pressure operational history, we find the enhanced surveillance monitoring program for these transmitters acceptable.

#### 3.2.4 Licensee Response to Requested Action 1.d

The licensee indicates there are two Rosemount transmitters from this transmitter classification at the Pilgrim Nuclear Power Station. These two transmitters indicate the reactor vessel level (two-thirds core coverage indication). Both transmitters have exceeded the 60,000 psi-month maturity criterion set by Rosemount and endorsed by the NRC. The licensee has monitored these transmitters using the accumulated drift data obtained from routine (refueling interval) calibrations. The licensee will discontinue this transmitter surveillance following the next (after the March 5, 1993, letter) calibration.

#### 3.2.5 Licensee Response to Requested Action 1.e

The licensee states they will exclude Rosemount transmitters in transmitter classifications 1.c and 1.d from the monthly enhanced surveillance monitoring program as each reaches its maturity threshold. The licensee will base that exclusion on the transmitter reaching that threshold while demonstrating a high degree of historical reliability. The Supplement allows this option.

With this option, the Supplement requires the licensee maintain a high degree of confidence that these transmitters remain highly reliable. The licensee states they will continue to review transmitter performance (based on calibration data) during refueling outages. This will maintain the high degree of confidence in these transmitters required of the licensee by the Supplement.

### 3.2.6 Licensee Response to Requested Action 1.f

The licensee states there are 26 Rosemount transmitters from this transmitter classification at the Pilgrim Nuclear Power Station. The Supplement does not require including low pressure transmitters in the enhanced surveillance monitoring program. However, the licensee has included these transmitters in the enhanced surveillance monitoring program, with a monitoring frequency based on the transmitter performance, until the transmitter reaches the maturity threshold. In addition, the licensee monitors 14 of these transmitters with the EPIC system. This allows the licensee to maintain a high degree of confidence that these transmitters remain highly reliable.

In addition, the licensee monitors the 33 Rosemount transmitters that, due to refurbishment or replacement, fall outside the scope of the Supplement. The EPIC system monitors thirty of these transmitters. The licensee excludes these transmitters from the enhanced surveillance monitoring program as performance data demonstrates a reliable operational history.

### 3.2.7 Enhanced Surveillance Monitoring Program

The licensee includes all 73 of their Rosemount transmitters in the enhanced surveillance monitoring program. The licensee incorporated the enhanced surveillance monitoring program into station procedures. Of the 73 transmitters, the EPIC system monitors 56 on-line. This includes the 12 transmitters evaluated monthly in classification 1.c. The licensee compares

the operational signals of redundant transmitters. Long-term drift between transmitters identifies a potentially degraded transmitter.

The licensee performs routine walkdowns looking for evidence of fill-oil leakage where feasible. The licensee trends the accumulated zero-shift calibration data for 43 transmitters to identify potentially degraded transmitters. The 30 transmitters not monitored with this method are outside the scope of the Supplement, being either refurbished or replaced. However, the licensee monitors them with the EPIC system. The enhanced surveillance monitoring program includes these transmitters for comparison of operational data to data from at-risk transmitters.

The enhanced surveillance monitoring program of the licensee meets the Requested Actions of the Supplement and is acceptable.

#### 4. CONCLUSIONS

Based on our review, we find the licensee has completed the reporting requirements of Supplement 1 of NRC Bulletin 90-01. Further, the licensee conforms to the requested actions of Supplement 1 to NRC Bulletin 90-01.

## 5. REFERENCES

1. NRC Bulletin No. 90-01: "Loss of Fill-oil in Transmitters Manufactured by Rosemount," March 9, 1990, OMB No. 3150-0011.
2. NRC Bulletin No. 90-01, Supplement 1: "Loss of Fill-oil in Transmitters Manufactured by Rosemount," December 22, 1992, OMB No. 3150-0011.
3. Letter, Boston Edison Company (E. T. Boulette) to NRC, "NRC Bulletin 90-01, Supplement 1: Loss of Fill-Oil in Transmitters Manufactured by Rosemount," March 5, 1993, BECo 93-032.
4. Letter, Boston Edison Company (E. T. Boulette) to NRC, "Long Term Program: Semi-annual Report," August 30, 1993, BECo 93-117.

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This report documents the Lockheed Idaho Technologies Company review of the Boston Edison Company submittals that respond to Supplement 1 to NRC Bulletin 90-01 for the Pilgrim Nuclear Power Station. This NRC bulletin provides information regarding the loss of fill-oil in certain pressure and differential pressure transmitters manufactured by Rosemount, Incorporated. This report finds the licensee conforms to the requested actions and the reporting requirements of the supplement.

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